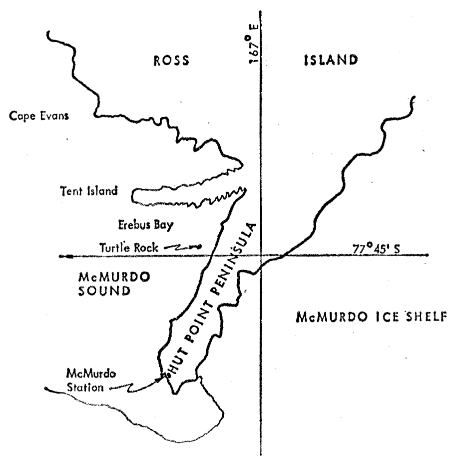

Fig. 1. Index map of the McMurdo Sound region, Antarctica.

to arrange a scuba dive beneath sea ice about 1.8 m thick near Turtle Rock in Erebus Bay (Fig. 1). Stalactites were abundant in this area and were observed closely; however, no exact measurements were made nor were samples collected.

The bottom of a growing sea ice sheet is characterized by an irregular surface with numerous disconnected ice platelets protruding downward. This layer has been termed the skeleton layer by Assur (*1*) and results from the separation and growth of pure ice platelets freezing from seawater (*2*).

The thickness of the skeleton layer beneath Arctic Sea ice has been described as being 1 to 2 cm (*3*), up to 2 cm (*4*), and 2.4 to 2.8 cm (*5*). However, direct observations beneath sea ice in Antarctica revealed that the skeleton layer was at least 10 to 15 cm thick and up to 60 cm or more in many locations. The bottom surface was extremely irregular with a relief of 30 to 60 cm (*6*). Part of the irregular bottom topography caused by uneven platelet growth consisted of ice (freshwater) stalactites extending downward from the growing sea ice.

Ice stalactites consist of freshwater ice frozen from seawater with the concurrent expulsion of brine. They occur singly or in groups and extend downward from 15 or 20 cm to 100 cm or more below the skeleton layer. They are sparse, averaging no more than three or four in an area of about 25 m^2. Two forms were observed within the same area and were growing under the same conditions; these forms are designated as the platelet-growth type and the ice-shell type.

The platelet-growth stalactite consists of ice platelets meshed together to form a hollow, slightly tapering, inverted cone hanging from the skeleton layer. Individual platelets are 1 to 2 mm thick with vertical or slightly inclined *c*-axis orientation predominating. The maximum base diameter appeared to be about 20 cm, tapering to a tip diameter of 6 to 10 cm over a length of about 100 cm.

All of the platelet-growth stalactites observed were hollow, and some contained brine of higher density than the surrounding seawater. Under ideal conditions of light, this brine could be seen draining downward from the tip of the stalactite. The stalactites are fragile but flexible enough to bend slightly with the gentle tidal currents; however, strong currents probably destroy the longer growths.

Ice-shell stalactities consist of a shell, 1 to 2 mm thick, that also forms an irregular hollow cylinder or cone tapering downward and having dimensions similar to the platelet-growth type. Platelet growth is poorly developed or absent along the sides of the stalactite, although a normal skeleton layer usually occurs around the base. These stalactites commonly occur singly or occasionally in groups. One stalactite consisted of three concentric hollow cones. The inner cone was about one-third the length and diameter of the outer cone, which was about 15 cm in diameter at the base and 80 cm long. The ice-shell stalactites are much more fragile than the platelet-growth type and are quite brittle; it is unlikely that they survive much disturbance and their existence is probably brief.

The ice stalactites probably result from a concentrated flow of dense, highly saline, cold brine draining into seawater of normal salinity (34 to 35 parts per thousand in McMurdo Sound). During the growth of sea ice, brine is expelled from seawater and becomes trapped as vertical, elongated cells at interplatelet boundaries. When growth occurs during the coldest part of the winter, most brine features are small and closely spaced except for occasional drainage channels that may become several millimeters in diameter. Occasionally, high-density brine may collect in several coalescing drainage channels that conduct it downward toward the bottom of the ice sheet. In addition to high salinity and density, brine trapped and draining from a thick ice sheet could also be quite cold. For example, at a depth of 1.5 m in sea ice 2 m thick, the ice temperature was −14°C early in November 1968.

When a large quantity of chilled, dense brine collects and begins to drain downward, stalactite growth is probably initiated as soon as the cold brine encounters seawater of normal salinity and near-freezing temperature. As platelets begin to grow around the periphery of the brine column, they in turn may add to the process of brine concentration. The platelet-growth stalactite is probably formed when a large amount of brine drains slowly during a long time period that allows for peripheral platelet growth. The ice-shell stalactite forms when a mass of cold, dense brine drains rapidly downward from the ice sheet and through the seawater. Ice continues to form until the density current gains heat from the surrounding seawater or until it dissipates.

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Scanning Electron Microscopy of Fresh Leaves of Pinguicula

Abstract. *Moist surfaces of leaves of* Pinguicula grandiflora *Lamck. can be observed directly by scanning electron microscopy, without metal coating. Samples dry out rapidly in the instrument, but during the first few minutes images can be obtained which must represent the natural state of the leaf surface.*

It has been commonly accepted that the biological applications of scanning electron microscopy are limited by the fact that samples have to be examined at very low pressures of the order of 10^{-5} torr and by the need to coat nonconducting specimens with conducting materials to prevent the accumulation of a surface charge (*1*). In a study of preparation of leaves (*2*) it was found that the pumping system of the instrument could easily cope with the water loss from small, partly hydrated leaf fragments and that satisfactory images could be obtained of the leaves of mesophytic species such as *Zea mays* and *Dianthus caryophyllus* during the first minute or two after introduction into the specimen chamber, before desiccation produced radical structural changes. With these species, as well as with others possessing well developed cuticles or waxy surface deposits, it was still found necessary to provide conductive coatings of 200- to 300-Å thickness of gold or gold-palladium alloy to prevent serious buildup of sur-

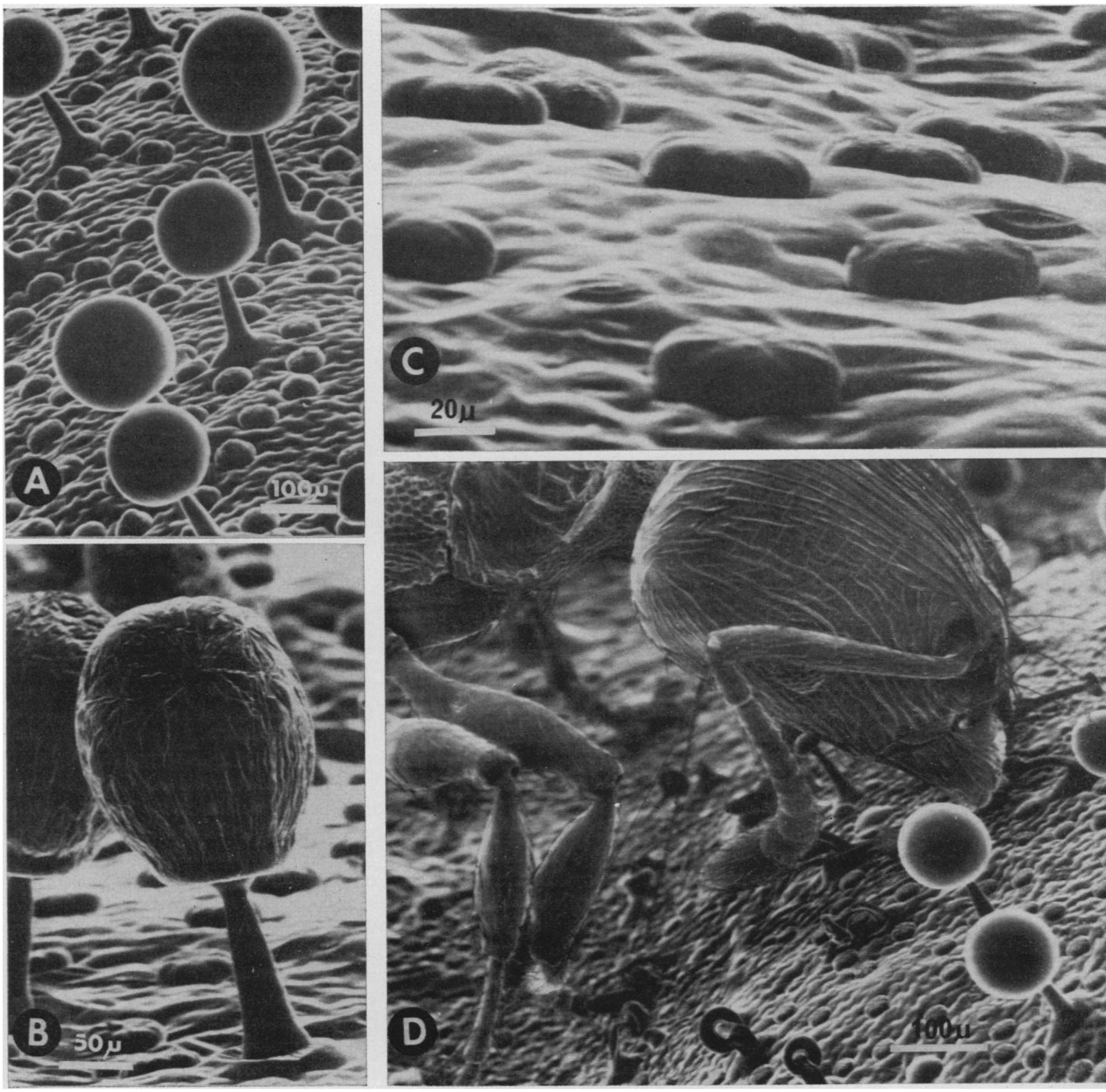

Fig. 1. (A) Leaf surface of *Pinguicula grandiflora* immediately after introduction into the vacuum of the miscroscope. The globules of mucilage are still perfectly retained over the head cells of the stalked capturing glands. The sessile digesting glands are slightly sunken in the epidermis, some bearing a small secretion droplet. (B) Stalked gland after 10 to 15 minutes in the microscope. The mucilage droplet is now shrinking, and its surface is thrown into folds. The large basal cell of the gland is also showing signs of loss of turgor. (C) Sessile glands after 10 to 15 minutes in the specimen chamber. The loss of turgor has thrown the radiating cells making up the gland head into slight relief and has accentuated the way these glands are sunken in shallow depressions in the epidermis. Two stomata are visible. (D) Leaf surface with a captured ant. Cables of mucilage extend between the ant's head and the heads of the stalked capturing glands. The stalked glands in the foreground have lost their turgor due to stimulation, and the stalk cells are bent over. The capturing glands to the right have not been stimulated and retain their mucilage globules.

face charge. With poorly cuticularized leaves, and where a film of moisture is present, there should be no need for coating, particularly if salt concentration is high. Such conditions are met in insectivorous plants of the genus *Pinguicula,* and I found that natural images of leaves of this genus can be obtained with no preparation whatever.

Observations were made on freshly expanded leaves of *P. grandiflora* Lamck. Fragments about 2 by 3 mm were cut from the lamina and attached immediately to the specimen stub with a thin film of slow-drying animal glue. Examinations were made with a Cambridge Instruments Stereoscan Mk IIa microscope. The stub was introduced into the specimen chamber oriented suitably before evacuation. No observable changes occurred in the central region of the leaf fragments during the first 4 or 5 minutes after the operational vacuum had been attained. Thereafter there was a progressive desiccation and change of surface features, but even after 15 minutes useful information could still be obtained. There was no evidence of serious charging effects with an accelerating voltage of 5 kv.

The leaf of *Pinguicula* bears two classes of glands, stalked and sessile (*3*). The stalked glands are responsible for insect capture, secreting an apical globule of adhesive mucilage. The sessile glands are enzyme-secreting, producing phosphatases, ribonuclease, proteases, and other hydrolytic enzymes (*4*). Before desiccation begins, the globule of mucilage on the stalked gland shows no surface features (Fig. 1A). As drying proceeds, a skin is formed and this falls into folds (Fig. 1B). The sessile glands are sunken in a slight pit. On first observation their cellular structure is not apparent, but with drying the eight or so radiating cells of the head are brought into relief (Fig. 1C).

On contact with an insect (Fig. 1D), the mucilage becomes affixed tenaciously, and the movements of the insect draw the adhesive out into cables (*5*). The glands lose turgor on stimulation, quickly collapsing against the epidermis. The leaf in the vicinity becomes slightly depressed (*6*), probably because of the loss of turgor of epidermal cells. Later, the sessile glands secrete a pool of enzyme-containing fluid in which digestion takes place. Note that the captured insect shows no evidence of surface charging; studies of living insects without conductive coatings have been made (*7*).

The fact that certain leaves can be examined without preparation opens up numerous possibilities in the high-resolution study of surface features. Apart from observations of glands and other appendages, it should be feasible to extend the study of the submicroscopic morphology of stomata (Fig. 1C) and transpiration control devices, taking advantage of the appreciable interval available for operation before substantial changes in the epidermes occur in the vacuum of the instrument.

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Mixed Permian-Triassic Fauna, Guryul Ravine, Kashmir

Abstract. *At Guryul Ravine near Srinagar, Kashmir, a varied fauna of productid brachiopods, including* Spinomarginifera, *is associated in approximately 15 feet (about 4 meters) of strata with the typical Scythian (Lower Triassic) pelecypod* Claraia. *These faunas are interpreted as true associations of surviving "Permian" and Lower Triassic faunal elements. Similar mixed associations have previously been identified in the lowest Triassic strata of the Salt Range and Surghar Range of West Pakistan.*

The exposures of Permian and Triassic formations in Guryul Ravine near Srinagar, Kashmir (34°6′N, 75°0′E), are justly famous in the annals of Himalayan stratigraphy. This sequence, first reported on by Hayden (*1*), was later given detailed attention by Middlemiss (*2*), who divided the sedimentary sequence above the Panjal volcanics into lithological units to which he did not give formal names (Fig. 1A). Middlemiss placed the boundary between the Permian and Triassic systems at the top of his "Black Shales" unit, from which he reported the bivalve *Pseudomonotis.* The Paleozoic rocks above the Panjal volcanics were named Zewan Series by Goodwin-Austin (*3*), and the top of this unit was extended by Wadia (*4*) to include the rocks of the "Limestone cliff" in Middlemiss's section (Fig. 1A).

During June 1968, we had the opportunity to study this section in the field. In the "Black Shales" unit of Middlemiss (Fig. 1), who considered this unit to be of Permian age, we discovered fossiliferous beds in which *Spinomarginifera* and other productid brachiopods, typically Permian in aspect, are in association with *Claraia,* a bivalve typical of the lower half of the Scythian Stage (Lower Triassic). The position of these beds is shown in Fig. 1B. The mixed faunas are found in approximately 15 feet (about 4 m) of strata. The "Sandy Shales" unit of Middlemiss, which, according to our observations, is essentially a calcerous sandstone, is overlain with a sharp contact by a few centimeters of coquinoid limestone composed of fragmented bivalve shells. About 1.1 m above this contact, we found a bed containing *Claraia* and unidentified productid brachiopods. At about 1.75 m above the contact, *Spinomarginifera* and other Permian-type brachiopods occur. The lowermost 12 feet (3.6 m) are best described as argillaceous limestone with some shaly interbeds. These are followed by a shale unit in which a bed with poorly preserved *Spinomarginifera* is overlain by a bed containing *Claraia.* Additional occurrences of *Claraia,* but not more Permian-type